EFFECTIVENESS OF PLYOMETRIC TRAINING PROGRAM TO IMPROVE ANKLE INSTABILITY AMONG VOLLEYBALL PLAYERS

DISSERTATION

Submitted for the partial fulfillment of the requirement for the degree of

MASTER OF PHYSIOTHERAPY (MPT)

(Elective - MPT SPORTS**)**

Done by

K.KRISHNAKUMAR

Bearing Registration No: 271550224

Submitted to:

THE TAMILNADU DR. M.G.R MEDICALUNIVERSITY

CHENNAI–600032.

APRIL - 2017

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Date:

Place: Chennai

Seal & Signature of Principal

……………………………………………….

Prof. R.RADHAKRISHNAN, MPT. PGDHM.

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Date:

Place: Chennai

Signature of Guide

…..………………………………

PROF R. RADHAKRISHNAN MPT,PGDHM

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CERTIFICATE

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………………………… ……….………………………

InternalExaminer ExternalExaminer

Place:

Date:

DECLARATION BY THE CANDIDATE

I hereby declare that the Dissertation entitled " **EFFECTIVENSS OF PLYOMETRIC TRAINING PROGRAM TO IMPROVE ANKLE INSTABILITY AMONG VOLLEYBALL PLAYERS**" was done by me for the partial fulfillment of the requirement of **Master of Physiotherapy** degree. The dissertation had been done under the direct supervision and guidance of my Guide at **Mohamed Sathak A.J college of Physiotherapy** , Chennai, and submitted the same during the year April2017 to **The Tamilnadu Dr.M.G.RMedical University**.

Date :

Place : Chennai

……………………………………………

Signature of the Candidate

ACKNOWLEDGEMENT

I thank **ALMIGHTY** for blessing me in all aspects to complete my dissertation successfully.

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TABLE OF CONTENTS

ABSTRACT

ABSTRACT

OBJECTIVE:

To evaluate the effectiveness of plyometric exercise training program to improve ankle instability among volleyball players

DESIGN:

Pre and post test A questionnaire experimental study

PARTICIPANTS:

Subject consist of 3O; 15 Suggestion undergoing plyometric exercise in control group;15 in experimental group

RESULT:

After the interpretation of data p-value is highly significant Cumberland ankle instability tool and visual analogue scale are measuring mean difference ankle instability of volley ball players.

CONCLUSION:

The study was conclude that plyometric training improve stability of volley ball players.

KEY WORDS: Plyometric ankle instability , volleyball player

INTRODUCTION

INTRODUCTION

An ankle sprain occurs when the strong ligaments that support the ankle stretch beyond their limits and tear[1]. Ankle sprains are common injuries that occur among people of all ages[2]. They range from mild to severe; depending upon how much damage there is to the ligaments. Although injuries are an aspect of all sports, there are certain injuries while volleyball players are more prone to the ankle sprains[3].

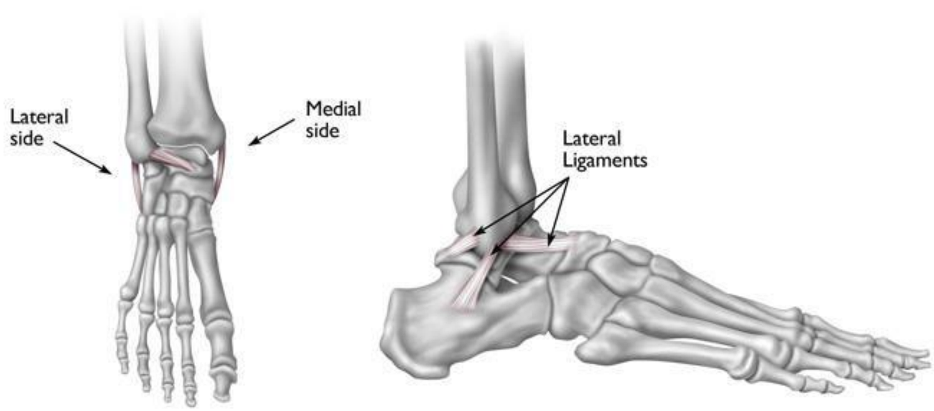
Of all sports, the volleyball players have a relatively high incidence of ankle sprains considering the sudden stops and cutting movements. The ankle instability is very common in novice volley ball players[4]. In athletics, the volleyball event is combination of cyclical running and the technical clearance of movements, however one of the most important elements in the determination of the final athletic result.

Studies considered model in the trial of biomechanical measure in Volley ball events, valuing specific movement at event of 110m, the ankle articulation angle in Volley ball approach (take off) is measured in two different situations: (Previous Support Phase, and Subsequent Support Phase, moment where it takes to higher of the CM), in not being took into account the intermediary moment between these two stages (Balance Phase)[6].

Take off at the saggital plan of the ankle and knee articulations angles of the leg support, the hip articulation angle in the lead leg, and the Ground

Reaction Force (GRF) at the moment from the volleyball players (take off), and at the landing moment after the volleyball players[7].

The evaluation criterion for an efficient technique volleyball players is to use the shortest possible time between approach and landing; this moment is defined as air phase and is the moment of greatest propensity to significant loss of speed, the landing phase is one of the most important movements performed on the Volley ball technical when it is the athletic employes a large power level which provides an improvement competitive final result.



A sprained ankle or twisted ankle is sometimes known as a common cause of ankle pain. A sprain is stretching or tearing of ligaments. The most common is an inversion sprain. Where the ankle turns over so the sole of the foot faces inward, damaging the ligaments on the outside of the ankle. Volleyball players who suffer from ankle sprains are more likely to injure the same ankle, which can result in disability and can lead to chronic pain or instability in 20% to 50% of these cases[11].

The high incidence of ankle sprains in volleyball players and their negative consequences for future sports participation.

The lateral ligament sprain, grade I and grade II injuries can be managed with conservative treatment the ankle should be treated with proper rest, ice, compression and elevation, taping, lace up brace , AROM are started early then additional rehabilitation with plyometric training and Peroneal strengthening is begun[12].

Plyometric training, also called reactive training, makes use of the stretch-shortening cycle to produce maximum force in the shortest amount of time and to enhance neuromuscular control efficient, rate of force production, and reduce neuromuscular inhibition.

Plyometric training is another measure, presumably as effective as braces and tape. This measure is already used in the rehabilitation following ankle sprain to re-strengthening muscles and ligaments and to restore the damaged structures around the ankle. Training is initiated for the recovery of ankle instability various materials have been specifically designed for this phase of rehabilitation[13].Plyometric training is done with agility ladder and cone. Use of these materials in training with a series of progressive drills can effectively return patients to a high functional level.

Plyometric exercise trains the muscle of effectively carryout the stretch-shorten cycle, which is pattern of muscle contraction involving a stretch of the muscle followed immediately by explosive contraction[14]. Therefore emphasizing this concept in the drills, which helps to develop the proper neuromuscular responds that can be carried over into the specific game related skills. It converts the elastic energy that is provided by athlete's body as well as force of gravity during eccentric muscle contraction. Plyometric exercise are include jump,hops, skips, bounds and thows.

Volleyball players should be recovered from their injury and need to be returned to their training as soon as possible without any disability of ankle pain and regain their performance at the sport. In a lateral injury, the mechanism of injury involves an invasion force. The injury may involve ligament damage occurring in the following order the anterior talofibular, calcaneofibular, posterior talofibular and tibiofibular ligaments. As more ligaments are involved, the severity of the injury increases.

The application of ice after ankle sprain is accepted clinical practice even if the strength of evidence supporting the use of Cryotherapy in management of acute soft tissue injury is generally poor.

The cumberland ankle instability tool (CAIT) questionnaire. The CAIT is different from other questionnaires in several ways. First, the CAIT does not require comparison with the contralateral ankle and secondly, concurrent, construct, and discriminative validity has been reported to the CAIT. The CAIT consists of nine questions with a total of 30 points possible, lower scores indicate more severe functional ankle instability. A score of less than or equal to 27 indicates a subject has functional ankle instability, whereas a score of 28 or higher indicates no FAI[17].

In this study we are going to see the effectiveness of plyometric training program to improve ankle instability among Volley ball players.

NEED FOR STUDY

NEED OF THE STUDY

Ankle sprain not only result in numerous visits to emergency care facilities and significant time loss from sports participation, but they can also cause long term disability. Among5.18million Players 15% (1 million) of athletes sustain ankle sprain due to the sudden twisting and cutting movements involved in sport. There are lot of conventional methods followed in many of the hospital and clinical settings according to the therapist way of treatment but the complete rehabilitation is not followed. Without adequate care, sprain can lead to chronic ankle instability and re-injury of ankle.

Though there are many treatments available, the part played by plyometric is something commendable and has a renounced effect in treating ankle instability. Protocol of plyometric training program covers all aspect of rehabilitation and make the patient return to activity without any recurrence or discomfort. Thus this study would purpose to find how effective is the above said therapy, the plyometrics in improving the ankle instability amongst the volleyball players.

AIMS AND OBJECTIVES

AIM AND OBJECTIVE OF THE STUDY

AIM:

The aim of the study is to evaluate the effect of six weeks of plyometric training program on improving ankle instability in volleyball players

OBJECTIVE:

To relive the pain and

To improve ankle instability among volleyball players

HYPOTHESIS

HYPOTHESIS

NULL HYPOTHESIS:

There is no difference between plyometric training program and conventional program on improving ankle instability among volleyball players

ALTERNATE HYPOTHESIS:

There is difference in plyometric training program than conventional program on improving ankle instability among volleyball players.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

ARTICLE LITERATURE

Bosco c, Titan j authenticated that stretch shortening cycle referred to a mechanical condition in which storing and recoiling of elastic energy occur in the skeletal muscle. This lead to a greater work out put when compared to a simple stretch shortening contraction.

Rusko sustained that enhancement of performance in stretch shortening exercise has been attributed to recoil of elastic energy stored during the stretching phase. They also suggested that if the time between were too long, then the static elastic energy would get wasted.

Adams, k., et al in a study has proposed that six weeks of squat plyometric training will improve the power production in a muscle. Journal of strength and conditioning.

Mc Ardle (1992) started that plyometric exercise make use of stretch recoil characteristic of skeletal muscle and modulation of muscle response via the stretch reflex. These exercise helps in the muscle strengthening process through short strengthening cycle.

Matavulji, et.al.., (2001) proposed that plyometric training program enhance the jumping performance in volleyball players journal of sports medicine and physical fitness.

LISA HARDY ET AL IN 2008: In his study on prophylactic ankle brace and star excursion balance measures in healthy: clinicians can be confident that the prophylactic use of ankle braces does not disrupt lower extremity dynamic balance during a reaching task in healthy participants.

Ronnestad B.E et.al..,2008 has proposed that short term plyometric training improves the sprint and jump performance in professional soccer players.

In **2008 F M Impellizzeri, E Rampini, C Castagna** conducted a study effect of plyometric training on sand versus grass on muscle soreness and jumping and sprinting ability in soccer players. Objectives says the lower impact on the musculoskeletal system induced by plyometric exercise on sand compared to a firm surface might be useful to reduce the stress of intensified training periods or during rehabilitation from injury. The aim of the study was to compare the effect of plyometric training on sand versus grass surface muscle soreness, vertical jump height and sprinting ability. Design was parallel two group, randomized, longitudinal (pre-test-post-test) study. Methods was after random allocation, 18 Soccer players completed 4 weeks of plyometric training on grass and 19 players on sand . Before and after plyometric training, 10m and 20m sprint time, squat jump, countermovement jump and eccentric utilization ratio (CMJ/SJ) were determined. Muscle soreness was measured using a Likert scale. Result says no training surface x time interactions were found for sprint time ($p>0.87$), whereas a trend was found for SJ (p=0.08), with both groups showing similar improvements ($p<0.001$). On the other hand, the grass group improved their CMJ (p=0.033) and CMJ/SJ (P=0.005) significantly ($P<0.001$) more than players in the sand group. In contrast, players in the sand group experienced less muscle soreness than those in the grass group (P=0.001) conclusion was plyometric training on sand improved both jumping and sprinting ability and induced less muscle soreness. A grass surface seems to be superior in enhancing CMJ performance while sand surface showed a greater improvement in SJ. Therefore, plyometric training on different surface may be associated with different training-induced effect on some neuromuscular factors related to the efficiency of the stretch-shortening cycle.

2008 Mansournia et al done a study on plyometric training for a 5 weeks to determine the effect of strength, speed, agility and fatigue index and mean power. They concluded there was significant improve of plyometric training for ankle sprained athletes.

2008 Kevin et al done a study on effect of two plyometric training techniques on power and agility in players and concluded that both depth jump and countermovement jump are worthwhile training activities for improving power and agility through vertical jump test and Illinois test

In **2010 A D Faigenbaum, G D Myer** conducted a study plyometric training among young athletes: safety, efficacy and injury prevention effects.

A literature review was employed to evaluate the current epidemiology of injury related to the safety and efficacy of youth training. Several case study reports and retrospective questionnaires regarding plyometric exercise and the competitive sports of weight lifting and power lifting reveal the injuries have occurred in young lifters, although a majority can be classified as accidental. Lack of qualified instruction that underlies poor exercise technique and inappropriate training loads could explain, atleast partly, some of the reported injuries. Current research indicates that resistance training can be a safe, effective and worthwhile activity for children and adolescents provided that qualified professional supervise all training session and provide age-appropriate instruction on proper lifting procedures and safe training guidelines. Regular participation in a multifaceted plyometric training program that begins during the preseason and includes instruction on movement biomechanics may reduce the risk of sports related injuries in young athletes. Strategies for enhancing the safety of young plyometric training program are discussed.

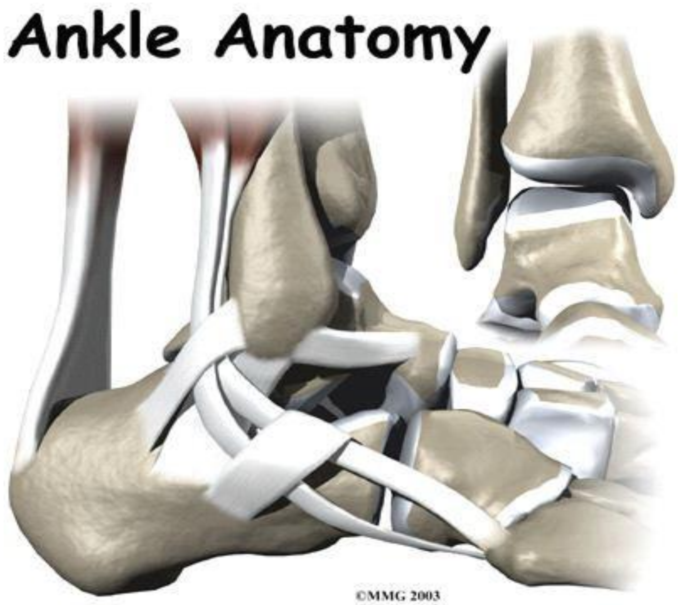
Saez de Villarreal E et.al.., 2012 in a study they had proposed that plyometric training improves sprint performance in young adults.

Vaczi M et.al.., (2013) said that short term high intensity plyometric training program improves strength,power and agility in male volley ball players 24subjects.

Lockie R.G et.al.., 2013 in a randomized controlled trail they have concluded that plyometric training improve sports acceleration speed technique.

STUDY LITERATURE

ANATOMY



The ankle joint acts like a hinge. The ankle is actually made up of several important structures. The unique design of the ankle makes it a very stable joint. This joint has to be stable in order to withstand 1.5 times of body weight while walking and up to eight times of body weight while running. Normal ankle function is needed to walk with a smooth and nearly effortless gait. The muscles, tendons, and ligaments that support the ankle joint work together to propel the body.

BIOMECHANICS

ANATOMY

- It is a Mortise:
- Tibial plafond (distal articular surface)
- Distal articular surface of fibula
- Superior trochlear surface of talar dome

LIGAMENTOUS STRUCTURE:

- Lateral collaterals (3)
- Medial collateral (deltoid)

ANKLE JOINT AXIS OF MOTION

- Projected medially, superiorly and anteriorly
- 25° from frontal plane
- 10° from transverse plane, but changes constantly as joint moves can be visualized as running through the tips of the malleoli.

ANKLE JOINT MOTION

- Primarily Dorsiflexion / Plantarflexion
- Dorsiflexion limited by anterior process of talus, triceps surae and posterior aspect of deltoid ligament
- Plantarflexion limited by posterior process of talus and anterior talo-fibular ligament
- DF associated with abduction and eversion
- PF associated withadduction and inversion

- Muscles acting at ankle joint
  - Main dorsiflexor: Tibialis anterior
  - Main plantarflexor: Gastroc-soleus
  - Dorsiflexors pass anterior to the axis
  - Plantarflexors pass posterior to the axis
  - Other muscles have little role in pure ankle joint function, but will affect joints distal to it

ANKLE JOINT IN GAIT

Slightly dorsi flexed at heel contact plantar flexes to foot flat. This is a means of shock absorbance and is controlled by eccentric contraction of tibialis anterior. Dorsiflexes as tibia moves over talus during forward progression this is passive.

Eccentric contraction of gastro-soleus plantar flexes during propulsion under active contraction of gastro-soleus group dorsi flexes during swing for ground clearance.

ANKLE JOINT STABILITY

- Talus wider anteriorly, so more stable in a dorsiflexed position
- Deltoid ligament (medial) is stronger than lateral collaterals.

PATHOMECHANICS:

Lateral ankle sprains most commonly occur due to excessive supination of the rear foot about an externally rotated lower leg soon after initial contact of the rear foot during gait or landing from a jump. Excessive inversion and internal rotation of the rear foot, coupled with external rotation of the lower leg, results in strain to the lateral ankle ligaments. If the strain in any of the ligaments exceeds the tensile strength of the tissues, ligamentous damage occurs.

Increased plantar flexion at initial contact appears to increase the likelihood of suffering a lateral ankle sprain.

The anterior talofibular ligament is the first ligament to be damaged during a lateral ankle sprain, followed most often by the calcaneo fibular ligament. Cadaveric-sectioning studies have demonstrated that after the ATFL is ruptured, the amount of transverse-plane motion (internalrotation) of the rear foot increases substantially, thus further stressing the remaining intact ligaments. This phenomenon has been described as “rotational instability” of the ankle and is often overlooked when considering laxity patterns in the sprained ankle. Concurrent damage to the talocrural joint capsule and the ligamentous stabilizers of the subtalar joint is also common with lateral ankle sprains. Martin et al demonstrated significantly greater strain in the cervical ligament after complete disruption to the CFL. The incidence of subtalar joint injury has been reported to be as high as 80% among patients suffering acute lateral ankle sprains. Injury to the posterior talofibular ligament is typical only in severe ankle sprains and is often accompanied by fractures or dislocations or both.

A pathomechanical model described by Fuller suggested that the cause of lateral ankle sprain is an increased supination movement at the subtalar joint. The increased supination moment is caused by the position and magnitude of the vertically projected ground-reaction force at initial foot contact.Fuller hypothesized that a foot with its center of pressure (COP) medial to the subtalar-joint axis has a greater supination moment from the vertical ground-reaction force than a foot with a more lateral relationship between the COP and the joint axis. This increased supination moment could thus cause excessive inversion and internal rotation of the rear foot in the closed kinetic chain and potentially lead to injury of the lateral ligaments. Individuals with a rigid supinated foot would be expected to have a more laterally deviated subtalar axis of rotation and a calcaneal varus (inverted rear foot) mal-alignment, which could predispose those with a rigid supinated foot to lateral ankle sprains.

Inman described great variation in the alignment of the subtalar-joint axis across individuals, and it is possible that those with a more laterally deviated subtalar-joint axis may be predisposed to recurrent ankle sprains. A foot with a laterally deviated subtalar-joint axis would have a greater area on the medial side of the joint axis. Thus, during initial foot contact, the likelihood is greater that COP would be medial to the subtalar-joint axis and the ground-reaction force would cause a supination moment at the subtalar joint. Additionally, the further medial the COP is in relation to the subtalar-joint axis, the longer the supination moment arm is. If the magnitude of this supination moment exceeds the magnitude of a compensatory pronation moment (produced by the peroneal muscles and the lateral ligaments), excessive inversion and internal rotation of the rear foot occur, likely causing injury to the lateral ligaments.

Relatively few research reports in the literature have described predispositions to first-time ankle sprains. Structural predispositions included increased tibial varum and nonpathologic talar tilt, whereas functional predispositions included poor postural-control performance, impaired proprioception, and higher eversion-to-inversion and plantar flexion-to-dorsiflexion strength ratios. Further research into prevention programs based on these predisposing factors is clearly warranted.

After acute injury, the ankle typically becomes swollen, tender, and painful with movement and full weight bearing. Depending on the severity of the injury, function usually returns over the course of a few days to a few months.

DESCRIPTION OF ANKLE SPRAIN

Of all the joints in the body, none is as complex as the ankle. Its intricate structure of bones, tendons, and ligaments is under the control of an equally complex group of muscles. The variety of movements performed by the ankle subject it to forces of a magnitude far out of proportion to its size. It is little wonder that ankle injuries are the most common of all joint injuries - about 1 million each year, of which approximately 85 percent are sprains.

When the ligaments that stabilize the ankle are overstretched or torn, the result is a sprained ankle, one of the most common exercise-related injuries. Although the risk is greatest during workouts that involve explosive side-by-side motion, such as in tennis or hurdlers, basketball can sprain an ankle during any weight-bearing activity, including walking.

Even sedentary people are vulnerable, since inactivity causes the muscles that support the ankle and protect the ligaments to lose strength and elasticity.

Inversion sprains are by far the most common type. These occur when the foot abruptly turns inward, putting tremendous stress on the ligaments on the outside of the ankle.

Eversion sprains, with stretching of the inside ligaments when the foot turns outward, are much less common.

Mild sprains, in which the ligaments are stretched only slightly beyond their normal limits, usually require minimal attention - if the pain and swelling are so mild as to permit normal weight bearing.

More severe sprains are quickly evident, with marked swelling, sharp pain, and evidence of bleeding under the skin. The worst sprain is one producing a complete tear of the ligament, putting the joint completely out of commission.

Sometimes what appears to be an ankle sprain is really a fractured bone. This can be of either the end of one of the long bones of the lower leg, the fibula, or a fracture of one of the bones of the foot. Thus, care must be taken with an injured ankle to make sure exactly what is injured.

CAUSES

Ligaments are injured when a greater than normal stretching force is applied to them. This happens most commonly when the foot is turned inward or inverted. This kind of injury can happen in the following ways:

Awkwardly planting the foot when running, stepping up or down, or during simple tasks such as getting out of bed

Stepping on a surface that is irregular, such as stepping in a hole.

Athletic events when one player steps on another player (a common example is a hurdlers player who goes up for a rebound and comes down on top of another player's foot. This can cause the rebounder's foot to roll inward.

Ankle sprain Inversion injury of ankle. Note it is turned inward.

Sprained ankles often result from a fall, a sudden twist or a blow that forces the ankle joint out of its normal position. Ankle sprains commonly occur. While participating in sports wearing inappropriate shoes, or walking or running on a uneven surface. Sometime ankle sprains occur because of weak ankle a condition that some people are born with.

SIGNS & SYMPTOMS

When an ankle is injured with a sprain, tissue injury and the resulting inflammation occur. Blood vessels become "leaky" and allow fluid to ooze into the soft tissue surrounding the joint. White blood cells responsible for inflammation migrate to the area, and blood flow increases as well. Typical changes that happen with inflammation include the following:

Because of increased fluid in the tissue is sometimes severe. Pain because the nerves are more sensitive: The joint hurts and may throb. The pain can worsen when the sore area is pressed, or the foot moves in certain directions (depending upon which ligament is involved) and during walking or standing.

- Redness and warmth caused by increased blood flow to the area.

- Ankle or foot injuries can also weaken the ankle and lead to sprains.

- Difficulty in walking

- Stiffness in the joint.

These symptoms may vary in intensity depending on the severity of the ankle sprain sometime pain and swelling are absent in people with previous ankle sprains instead, they may simply feel the ankle in wobbly and unsteady when they walk.

GRADES OF SEVERITY FOR SPRAINED ANKLE (American college of foot and ankle surgeon : preferred practice guideline no.1/97)

GRADES 1 SPRAIN

- Some stretching or perhaps minor of the lateral ankle ligaments
- Little or no joint instability
- Mild pain
- There may be mild swelling around the bone on the outside of the ankle
- Some joint stiffness or difficult walking or running.

GRADE 2 SPRAIN

- Moderate tearing of the ligament fibers

- Some instability of the joint

- Moderate to severe pain and difficulty joint

- Swelling and stiffness in the ankle joint

- Minor bursing may be evident

GRADE 3 SPRAINS

- Total rupture of a ligament
- Gross instability of the joint
- Severe pain initially followed later by no pain and difficulty joint
- Severe Swelling
- Usually extensive brusing

INVESTIGATION

X-ray Tests

X-ray test can also be performed to assess the stability of the ankle. By placing a stress on the ligaments, and taking an x-ray and careful evaluation is done for any possible tearing away of bone where the ligaments get attached and it will also show any loose fragments or other if they are present.

Magnetic Reasonance Imaging

MRI is a non-invasive test that produces excellent imaging of all parts of ankle. In this test the individual lays hollow cylinder while powerful magnets create signals from inside ankle. These signals are then converted into a computer image that clearly shows any damage to the structure inside the joint. The images are valuable not only to determine the presence of ligament tear but also the degree of tear along with any other damage to the related structures.

Physical examination

- **Anterior drawer test:** Specific for assessing the interity of anterior talofibular ligament by the amount of anterior-talar displacement that can be produced in sagittal plane.

Procedure

- Sitting with knee flexed to relax calf muscles Therapist grasps the heel firmly in one hand and pulls forward while holding the anterior aspect of distal tibia stable with other hand Increased anterior translation of the talus with respect to the tibia is a positive sign and indicates tear of ATFL.

- Translation is reported to be anywhere from 2mm to 9mm.

KNOWLEDGE OF PLYOMETRICS

Plyometrics

Plyometrics have been described or drill that combine speed and strength to produce an explosive reactive movement or increased power (duda 1988). Plyometric increase speed quickness and power. Plyometric is a type of resisted training program that involves the rapid stretching of the muscle from eccentric contraction to concentric contraction in order to produce a forceful movements in a short period of time (duda 1988)

Plyometric exercise trains the muscle to effectively carryout the stretch-shorten cycle , which is pattern of muscle contraction involving a stretch of the muscle followed by explosive contraction. Its is to convert the elastic energy that is provided by athlets body as well as the force of gravity during the eccentric contraction of the muscle into an equal and opposite force during concentric muscle contraction (duda 1988, bertucei 1978)

PHYSIOLOGY OF PLYOMETRICS :

A muscle that is stretched before a concentric contraction, will contract more forcefully and rapidly. A classic example is a dip just prior to a vertical jump . by lowering the center of gravity quickly, the muscle involved in the jump are momentarily stretched producing a more powerful movement. But why does this occur? Two model have been proposed to explain this phenomenon the first is the

MECHANICAL MODEL:

In this model, elastic energy is created in the muscle and tendons and stored as a result of a rapid stretch . This stored energy is then realesed when the stretch is followed immediately by a concentric muscle action. According to hill the effect is like that of stretching a spring, which to return to its natural length.

The spring is this case a component of the muscles and tendons called the series elastic components.

NEUROPHYSICAL MODEL:

When a quick stretch is detected in the muscle, an involuntary, protective response occurs to prevent overstretching and injury. This response is known as the stretch reflex. The stretch reflex increase the activity in the muscle undergoing the stretch or eccentric muscle action, allowing it to act much more forcefully. The result is a powerful braking effect and the potential for a powerful concentric muscle action.

If the concentric muscle action does not occur immediately after the pre-stretch the potential energy produced by the stretch reflex response is lost. (i.e. if there is a delay between dipping down and then jumping up is effect of the counter-dip is lost)

It is thought that both the mechanical model (series elastic component) and the neurophysical model (stretch reflex) increase the rate of force production during plyometrics exercise.

STRETCH-SHORTENING CYCLE:

All plyometric movements involve three phase. The first phase is the pre-stretch or eccentric muscle action. Here, elastic energy is generated and stored.

The second phase is the time between the end of the pre-stretch and the start of the concentric muscle action. This brief transition period from stretching to contracting is known as the amortization phase. The shorter this phase is, the more powerful the subsequent muscle contraction will be.

The third and final phase is the actual muscle contraction. In practice, this is the movement the athlete desires the powerful jump or throws.

This sequence of three phases is called the stretch-shortening cycle. In fact, plyometric could also be called stretch-shortening cycle exercise.

MANAGEMENT

1. First aid treatment
2. Early functional rehabilitation
3. Training for return to activity.

1.First aid treatment:

The early treatment of ankle sprain is the "RICE" method of treatment. The following is an explanation of the RICE method of treatment for ankle sprains:

- REST: Immobilization of the joint should be done in order to prevent further damage to the joint. To facilitate early rehabilitation and cryotherapy an easily removable device, such as plastic ankle foot orthosis or simple plaster posterior splint may be employed for immobilization.
- ICE: Cryotherapy should be used immediately after the injury. Crushed ice in a plastic bag applied to the media and lateral ankle. Foot and ankle cooled by immersion in water at a temperature of 12.7°c for approximately 20 min every 2 or 3 hours for first 48hours of injury or until edema and inflammation have stabilized.
- COMPRESSION: Ankle should be wrapped with an elastic bandage. Bandaging should start just proximal to the toes and extend above the level of maximal calf circumference in order to milk edema fluid away from the injured tissues.
- ELEVATE: Elevation should about 15-25cm(6-10inch) above the level of heart to facilitatevenous and lymphatic drainage until the swelling has begun to resolve.

2. <u>Early functional rehabilitation:</u>

- A painful edematous sprained ankle tends to stiffen in a plantar flexed slightly inverted position.
- Unless this stiffening is prevented rehabilitation has to be delayed until range of motion is slowly regained.
- Air-filled or gel filled ankle braces that restrict inversion-eversion and a low limited plantar flexion-dorsiflexion facilitate rehabilitation

Range of Motion Exercises:

- ROM must be regained before functional rehabilitation is initiated.
- Regardless of weight-bearing capacity following exercises should be
- instituted within 48-72 hours of injury.
- Some simple exercises can help maintain ankle motion, and stretch the injured ligaments in the ankle joint.

Achilles stretch: use a towel to pull foot toward face. Pain free stretch for 15-30seconds performs five repetitions repeat 3-5 times a day. 5 seconds of rest/set.

METHODOLOGY

METHODOLGY

STUDY DESIGN:

- pre and post experimental study

- pre and post control study

STUDY SETTING:

- Outdoor based setting.

SAMPLE DESIGN:

- Non- probability convenient sampling.

SAMPLE SIZE:

- The samples (n) = 30 subjects who fulfilled the inclusion criteria.

INCLUSION CRITERIA

- Age = 18 -30 years
- SEX: Male athlete Subjects with post injury of ankle sprain grade II of duration 2-3weeks

EXCLUSION CRITERIA:

- Neurological problems
- Any recent fracture

- Any pediatric disease
- Any bone mal alignment

STUDY DURATION:

- 6 weeks , 3 session/week ,60mins

OUTCOME MEASUREMENT TOOLS:

- Cumberland ankle instability tool

- Visual analogue scale

MATERIALS USED:

- Cones
- Stop watch
- Hurdle
- Agility ladder

MATERIALS USED: AGILITY LADDER, CONES, HURDLES

PROCEDURE

PROCEDURE

The subjects were selected upon the inclusion criteria and Cryotherapy were applied for a period of 2 weeks for about 15-20mins and at the end with the application of crepe bandage. Pre-test analysis were done with the VISUAL ANALOUGE SCALE prior to the application of cryotherapy and at the end of 2 weeks after the pain subsided the subjects were put on for plyometric training for next 4 weeks with the duration of 60-90 mins per session for 3 session

per week . Prior to the plyometric training 5-10 mins warming up which included static jogging stretching and other free exercises were given. During plyometric training in between rest periods were given according to the need of the subject. The Cumberland ankle instability test was used to evaluate the functional outcome before the commencement and at the end of plyometric training .ie, before and after 4weeks. This tool is a self-assessed and perception based

survey of an individual's ankle instability consisting of 9 questions. Respondents may score between 0 and 30 with lower scores indicating decreased ankle stability, and higher scores indicating increased stability. For the purpose of this study we will be utilizing cut-off scores of both <25 and <27 in distinguishing between stable versus unstable ankles.

In control group only given cryotherapy with crepe bandage and active exercise.

INTERVENTION PROCEDURE

- PLYOMETRIC EXERCISE PROTOCOL

1st& 2nd week

- Cryotherapy
- Crepe bandage application

3rd& 4th week training

- Squats jumps
- Ankle jump
- Jump for a distance
- Split-squat jump (right/left)
- Hop for a distnce (right/left)
- Forward zigzag hops(right/left)
- Lateral saw tooth hops (right/left)
- Tuck jumps
- Diagonal hop
- Jump on a step

5th & 6th week training

- Cycled single leg squat jumps
- Hop on a target
- Jump for a distance and height
- Forward zigzag hops (right/left)

- Lateral saw tooth hops (right/left)
- Tuck jumps
- Agility ladder
- Jump on a step

FORWARD ZIGZAG HOPS **JUMP FOR A DISTANCE AND HEIGHT**

AGILITY LADDER

DATA ANALYSIS

DATA ANALYSIS

MEAN DIFFERENCE

t-test

CAIT -Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	P- value
CAIT - PRE TEST VALUE	**EXPERIMENTAL GROUP**	**15**	**22.13**	**1.246**	**.322**	**.537**
	CONTROL GROUP	15	21.87	1.552	.401	
CAIT - POST TEST VALUE	EXPERIMENTAL GROUP	15	27.13	1.246	.322	.000
	CONTROL GROUP	15	24.27	1.624	.419	

VAS -Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	P- value
VAS - PRE TEST VALUE	EXPERIMENTAL GROUP	15	6.40	1.298	.335	**.357**
	CONTROL GROUP	15	6.87	1.187	.307	
VAS - POST TEST VALUE	EXPERIMENTAL GROUP	15	2.27	.961	.248	**.000**
	CONTROL GROUP	15	5.00	.845	.218	

EXP

ERIMENTAL GROUP -Group Statistics

Paired Samples Statistics

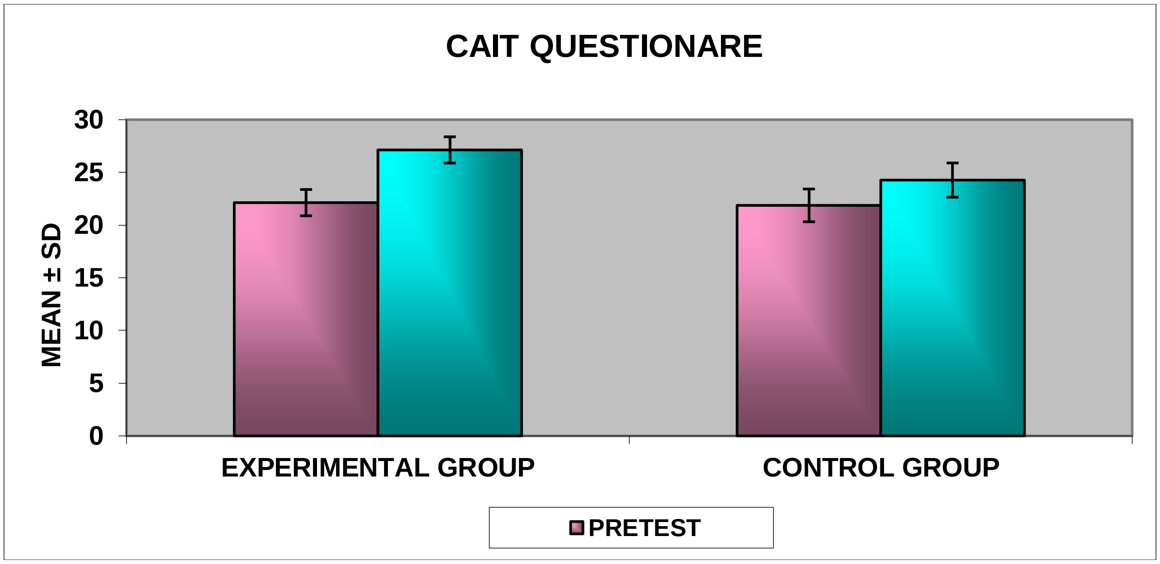
		Mean	N	Std. Deviation	Std. Error Mean	P- value
Pair 1	CAIT - PRE TEST VALUE	22.13	15	1.246	.322	.000
	CAIT - POST TEST VALUE	27.13	15	1.246	.322	
Pair 2	VAS - PRE TEST VALUE	6.40	15	1.298	.335	.001
	VAS - POST TEST VALUE	2.27	15	.961	.248	

CONTROL GROUP -Group Statistics

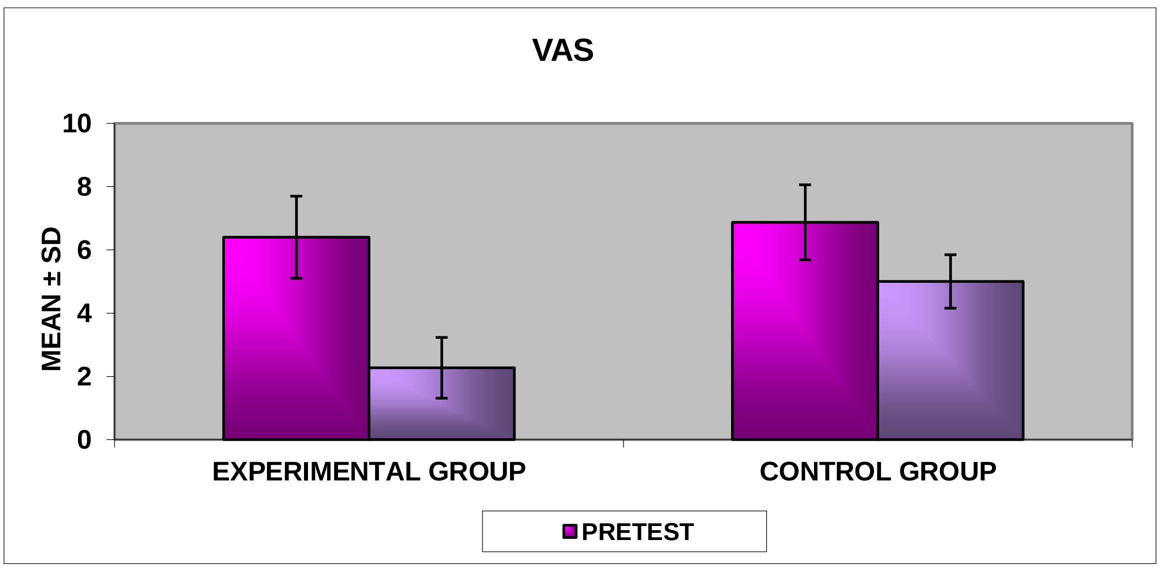
Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean	P- value
Pair 1	CAIT - PRE TEST VALUE	21.87	15	1.552	.401	.000
	CAIT - POST TEST VALUE	24.27	15	1.624	.419	
Pair 2	VAS - PRE TEST VALUE	6.87	15	1.187	.307	
	VAS - POST TEST VALUE	5.00	15	.845	.218	.001

BAR DIAGRAM



CAIT QUESTIONARE
30
25
20
15
10
5
0
MEAN ± SD
EXPERIMENTAL GROUP
CONTROL GROUP
PRETEST



VAS
10
8
6
4
2
0
MEAN ± SD
EXPERIMENTAL GROUP
CONTROL GROUP
PRETEST

RESULT

RESULT

Cumberland Ankle Instability Tool

Pre-test mean value for Experimental group 22.1

Control group 21.9

Post-test mean value for Experimental group 27.1

Control group 24.0

Visual Analogue Scale

Pre-test mean value for Experimental group 6.4

Control group 6.8

Post-test mean value for Experimental group 2.2

Control group 5.0

DISSCUSSION

DISCUSSION

Muscle strength is vital to perform physicial activity of daily living requirement of strength is more in cases of activity as to bring about a competitative performs .

30 volley ball players were taken on divided IN two group each consisting 15 members .One group cumber land ankle instability tool and other group visual analogue scale .

This study was performed to cumber ankle instability questionare tool pre and post test value.

Data analysis was done mean difference to comparision of pre test and post test mean value of both Cumberland ankle instability questionare and visual analogue scale.

The accuracy of the jumping result lowering center of gravity quickly, muscles involved jumping movements more power full stretching of ankle joint.

Contracts The athlete involved in jumping have an harm full effects of repetitive stretch of ankle joint and the key to maintain muscle balance with in the ankle complex in this volley ball players.

LIMITATIONS AND RECOMANDATIONS

LIMITAION AND RECOMENDATION

This study was done for short duration, longer duration of exercise program can be recommended.

The study was concluded in the age group 18-25, age more than concluded.

In this study ankle joint are concentrated, other part of the body muscles may also be concentrate in further studies.

The study was done only on experimental and control groups.

CONCLUSION

CONCLUSION

From this study it shows that plyometric training program has proved to be effective in improving ankle sprain among volleyballplayers, although the strengthening is an important consideration during ankle sprain rehabilitation deficits of ankle strength. The approaches that involve plyometric training program improves the ankle instability for athletes and also, the plyometric training improves the neuromuscular, neuro-motor, sensory-motor system and improving a static and dynamic balance and decreases the recurrence of injury with ankle sprained subjects.

Evidence are suggested more over different types of training are available, such a plyometric training is improving the ankle instability and to prevent a further injury in future.

The study concludes that the plyometric training program is effective in improving ankle instability among volleyball players.

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APPENDIX

APPENDIX

(i) CONSTENT FORM

I, Mr. / Mrs. / Ms ______________________Voluntarily consent to participate in the project study named "EFFECTIVENESS OF PLYOMETRIC TRAINING PROGRAM TO IMPROVE ANKLE INSTABILITY AMONG HURDLERS" The physical therapy student has explained me about the procedure in detail. Here I assure that I will adhere to the treatment programme prescribed to me and have been given the liberty to withdraw myself from programme at any time with knowledge of the physical therapy student.

Participant's signature :

Signature of witness :

Sign of physical therapy student :

Date :

Place :

(ii) ASSESMENT CHART

SUBJECTIVE EXAMINATION

Name :

Age :

Sex :

Occupation :

Address :

Date of assessment :

Chief complaints :

Dislocation of knee joint : yes/no

Hyper mobility : yes/no

Recent fracture around the knee : yes/no

Neurological disorder : yes/no

Weight: kgs,

Height : cms

HISTORY :

PRESENT MEDICAL HISTORY :

Duration of illness

Severity of the conditions

Drugs taken for pain and symptoms

PAST MEDICAL HISTORY :

Previous onset of neck pain
Drugs taken
Any previous physiotherapy treatment

OBJECTIVE EXAMINATION
On Observation

General body built

Attitude of limb

Musculature

Deformity

Posture

On palpation

Warmth

Tenderness

Muscle spasm

Swelling

Scar tissue

Muscle spasm

Oedema

Bony prominence

On Examination

PAIN ASSESSMENT (VAS)

Onset-

Duration

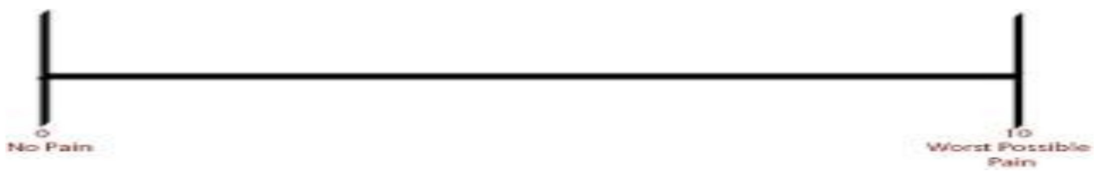
Site of pain
Side of pain
Type of pain

Nature of pain

Aggravating factor

Relieving factor

VAS score 0-10



Special tests:

- Anterior drawer test

Sensory examination:

- Temperature
- Pressure

Motor examination:

- Muscle power assessment
- Joint range of motion

Diagnosis:

- Special tests
- Medical imaging

Aims of treatment:

Means of the treatment:

Home program:

Follow up:

HOME PROGRAMS:

Do's

- Try to sleep with your leg out straight at night instead of curing up into a ball.
- Static exercise of quadriceps and hamstring can be done to prevent muscle weakness.
- Step climbing and mini squats can be encouraged.
- Step climbing and mini squats can be used which provides stability to the knee joint.

Don'ts:

- Squatting
- Twisting movement of the knee
- Walking on slippery or uneven terrain
- Sporting activities

FOLLOW UP:- After treatment visit once in a week.

(iii) SCALES

(a) THE CUMBERLAND ANKLE INSTABILITY TOOL

THE CAIT QUESTIONNAIRE

Please tick the ONE statement in EACH question that BEST describes your ankles.

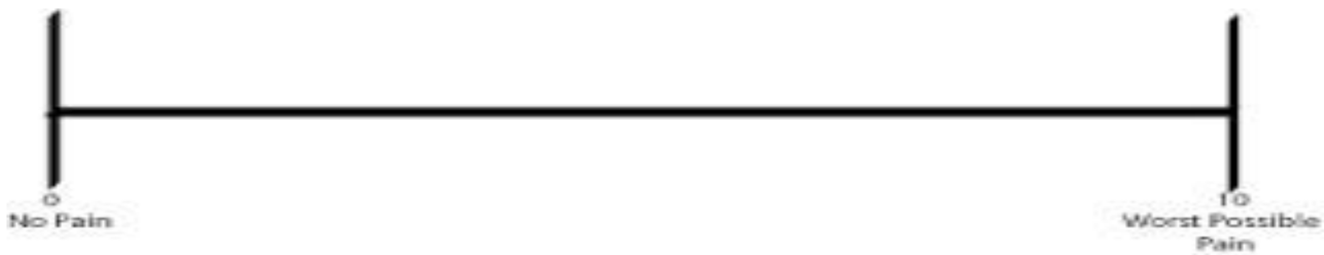
	LEFT	RIGHT	Score
1. I have pain in my ankle			
Never	☐	☐	5
During sport	☐	☐	4
Running on uneven surfaces	☐	☐	3
Running on level surfaces	☐	☐	2
Walking on uneven surfaces	☐	☐	1
Walking on level surfaces	☐	☐	0
2. My ankle feels UNSTABLE			
Never	☐	☐	4
Sometimes during sport (not every time)	☐	☐	3
Frequently during sport (every time)	☐	☐	2
Sometimes during daily activity	☐	☐	1
Frequently during daily activity	☐	☐	0
3. When I make SHARP turns, my ankle feels UNSTABLE			
Never	☐	☐	3
Sometimes when running	☐	☐	2
Often when running	☐	☐	1
When walking	☐	☐	0
4. When going down the stairs, my ankle feels UNSTABLE			
Never	☐	☐	3
If I go fast	☐	☐	2
Occasionally	☐	☐	1
Always	☐	☐	0

6. My ankle feels UNSTABLE when			
Never	☐	☐	3
I hop from side to side	☐	☐	2
I hop on the spot	☐	☐	1
When I jump	☐	☐	0
7. My ankle feels UNSTABLE when			
Never	☐	☐	4
I run on uneven surfaces	☐	☐	3
I jog on uneven surfaces	☐	☐	2
I walk on uneven surfaces	☐	☐	1
I walk on a flat surface	☐	☐	0
8. TYPICALLY, when I start to roll over (or "twist") on my ankle, I can stop it			
Immediately	☐	☐	3
Often	☐	☐	2
Sometimes	☐	☐	1
Never	☐	☐	0
I have never rolled over on my ankle	☐	☐	3
9. After a TYPICAL incident of my ankle rolling over, my ankle returns to "normal"			
Almost immediately	☐	☐	3
Less than one day	☐	☐	2
1–2 days	☐	☐	1
More than 2 days	☐	☐	0
I have never rolled over on my ankle	☐	☐	3

(b) VISUAL ANALOG SCALE (VAS)

The task were explained to the patient and instructed to perform the task. The score were evaluated to the performance of the patient. The tests were conducted before and after the treatment procedure.

A visual analogue scale is a 10cm line, oriented vertically or horizontally, with one end indicating “No pain “ and other end representing “worst Pain’’ as bad as it can be. The subject will be asked to mark a point corresponding to the intensity of pain.



TASK____

DATE________________START___________________END_____________________

MASTER CHART

Cumberland ankle instability questionare tool pre-test and post test value

Experimental group

S.NO	PRE TEST	POST TEST
1	22	28
2	20	26
3	22	28
4	21	26
5	20	25
6	22	27
7	23	28
8	22	26
9	23	28
10	24	29
11	22	26
12	23	28
13	24	29
14	23	27
15	21	26

Cumberland ankle instability questionare tool pre-test and post test value

Control group

S.NO	PRE TEST	POST TEST
1	23	25
2	22	24
3	20	22
4	20	23
5	22	24
6	23	25
7	25	27
8	23	24
9	20	22
10	21	24
11	23	25
12	24	26
13	22	24
14	20	22
15	21	24

Visual Analog scale tool pre-test and post test value

Experimental group

S.NO	PRE TEST	POST TEST
1	6	2
2	8	4
3	5	3
4	4	2
5	6	1
6	7	2
7	6	3
8	7	2
9	8	2
10	5	1
11	8	4
12	6	3
13	7	2
14	8	2
15	5	1

Visual Analog scale tool pre-test and post test value

Control group

S.NO	PRE TEST	POST TEST
1	8	5
2	7	5
3	7	6
4	8	5
5	6	5
6	5	4
7	6	5
8	5	4
9	6	4
10	7	5
11	8	5
12	9	6
13	8	7
14	7	5
15	6	4